

# The Kissimmee River Floodplain Under Low-flow Conditions



- Inundation of the Kissimmee River floodplain is dependent on higher levels of discharge from water control structures to the north.
- For example, in the photo to the left taken last May, flow from the north was low and was contained within the river channel, leaving sandbars exposed and the floodplain dry.

*\*\*A water depth map for May 30 is shown in the inset. Maroon colors denote drier conditions; yellow denotes water just above ground.*

Starvation Slough at low flow (5/30/17)

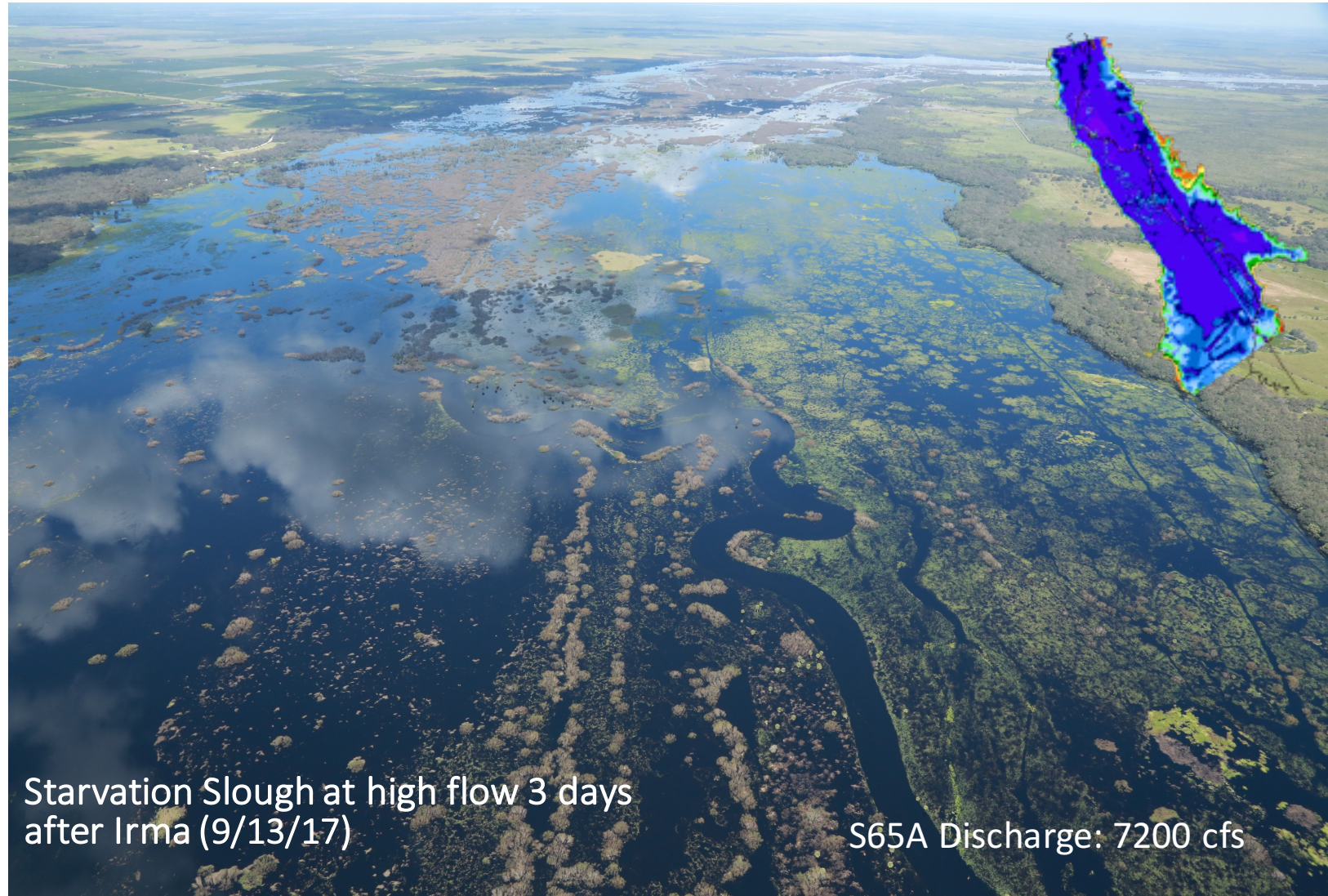
S65A Discharge: 130 cfs



## The Kissimmee River Floodplain Under High-flow Conditions

- After a large rain event like H. Irma, flow from the north may need to be increased dramatically to provide flood control in the Kissimmee Chain of Lakes upstream. In the photo below, taken 3 days after Irma, water has overtopped the river's banks and spread over the surrounding floodplain, inundating the floodplain.
- The dark bands of forest on both sides of the floodplain mark the outer edges of the floodplain where floodplain wetlands transition into upland oak hammocks.
- Ecologically, annual flood pulses are desirable (although ideally less extreme events than Irma!) and are essential to maintain floodplain wetlands in low-gradient river ecosystems.

*\*\*A water depth map for September 13 is shown in the inset. Increasingly dark blues denote increasingly deep water.*

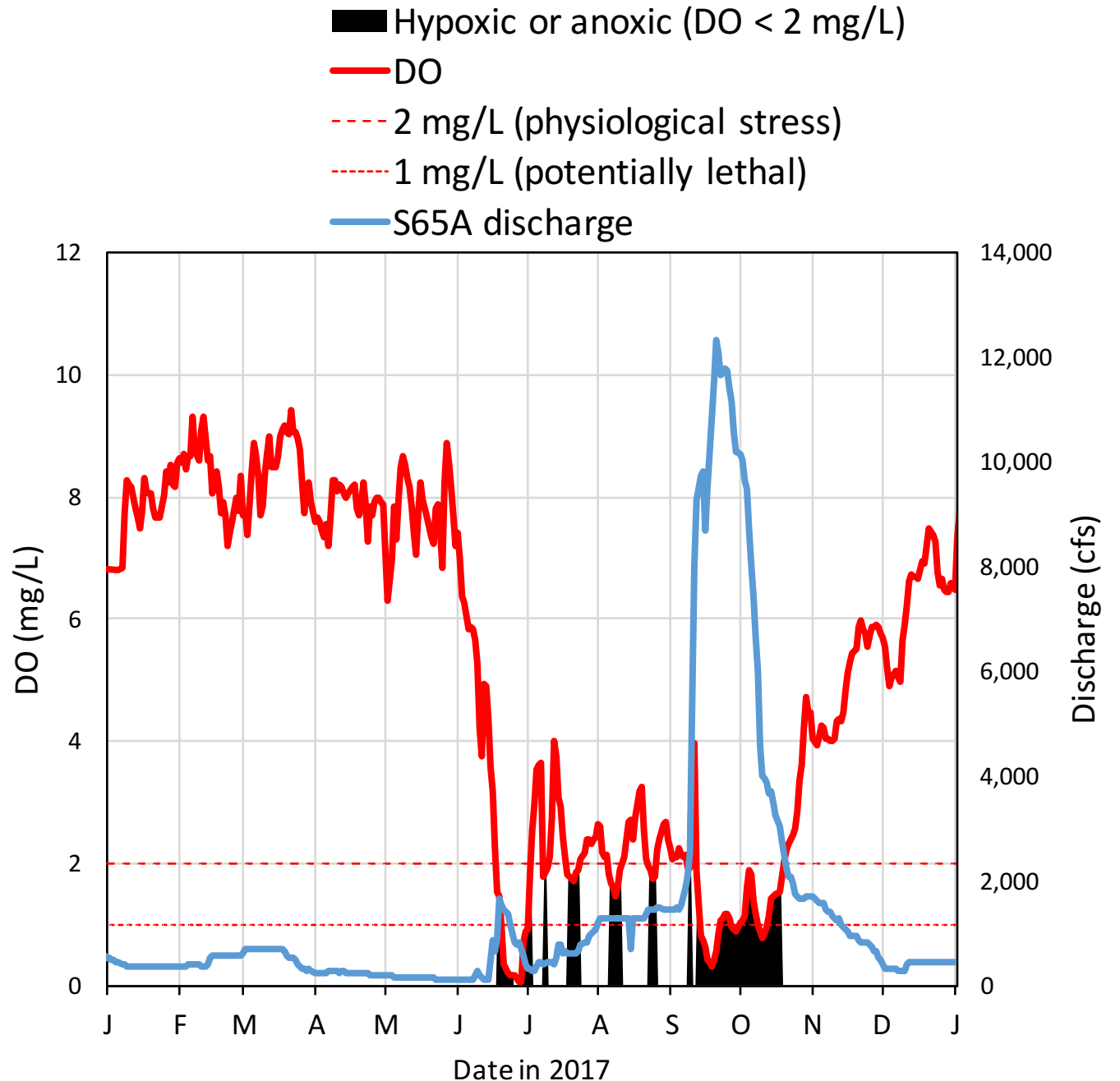


Starvation Slough at high flow 3 days after Irma (9/13/17)

S65A Discharge: 7200 cfs

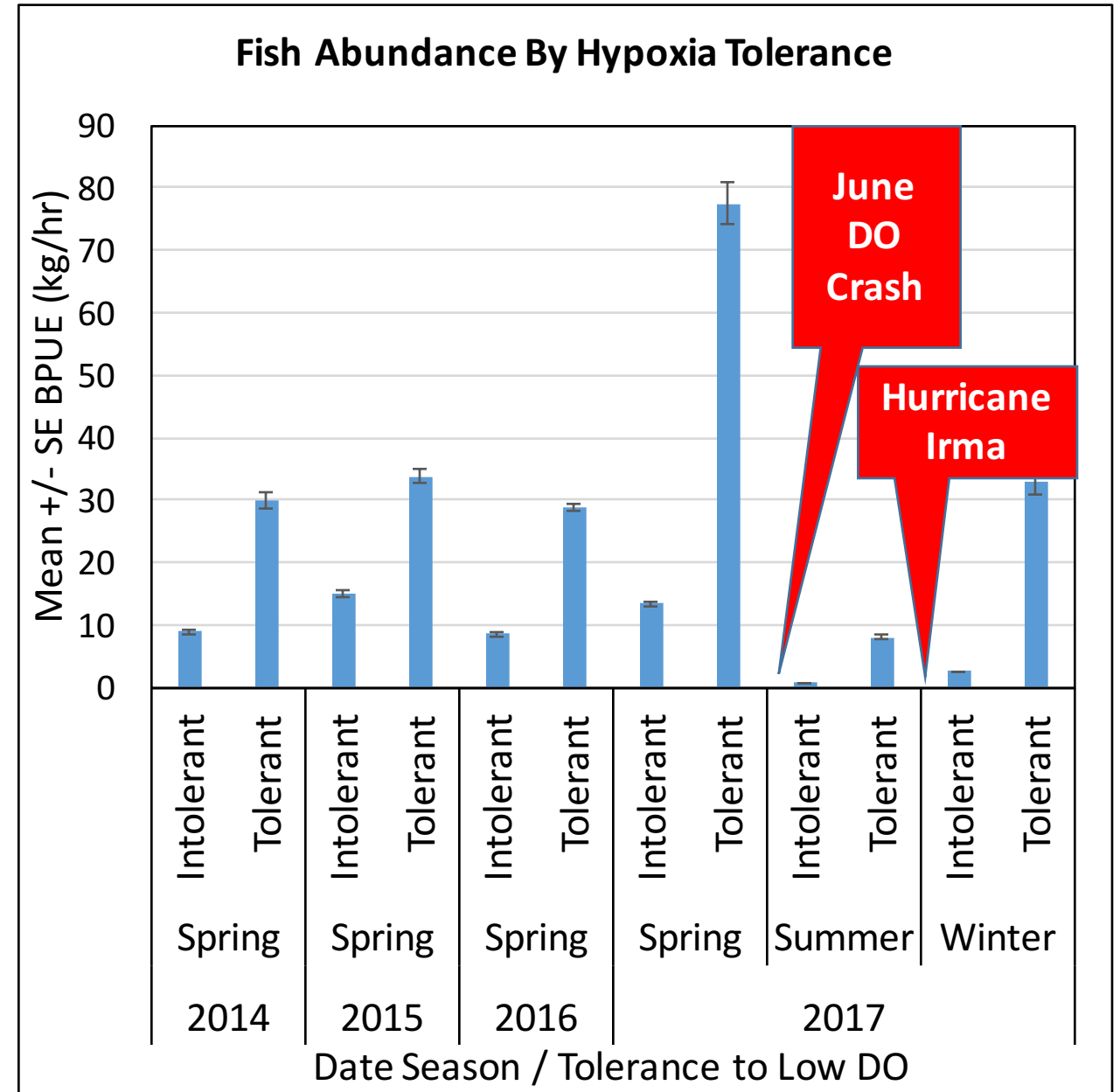
# Flow and Dissolved Oxygen

- This graph of DO and flow in 2017 shows the typical negative correlation seen in the Kissimmee River between discharge at S65A and dissolved oxygen.
- Rising flow causes DO to decline primarily because it causes water depth to rise, reducing the amount of sunlight reaching photosynthetic organisms.
- When discharge must be increased quickly for flood control, the result is often deep sags in DO, especially in the wet season when temperatures are high.
- Such declines can impact fish populations.
- An hypoxic condition is when DO declines to  $< 2$  mg/L, which causes physiological stress in many fish.
- Anoxic conditions (DO  $< 1$  mg/L) can be lethal to sensitive species like bass and other sunfish.



# Fish Populations and the 2017 Hypoxic Events

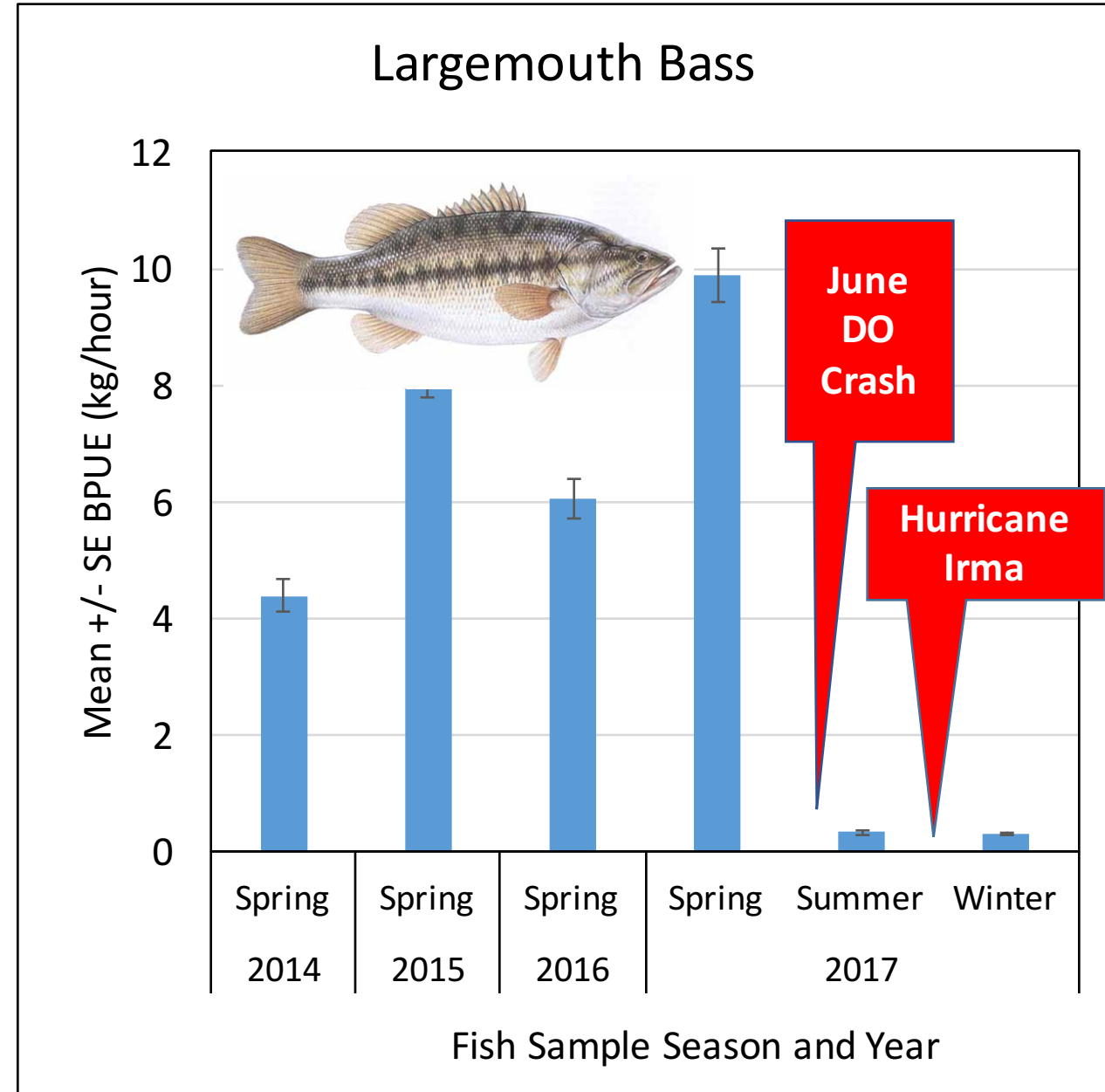
- Largemouth bass, bluegill, and other sunfish are very sensitive to low DO (hypoxic) conditions and may be killed.
- Other fish species, for example Florida gar, catfish, and many exotic fish, are relatively tolerant of low DO.
- The graph to the right shows the responses in our survey data of intolerant species (primarily sunfish) and tolerant species.
- With the three 2017 samples we were able to document likely effects on populations of both sunfish as a whole (this slide) and bass alone (next slide).





# Bass Response to the 2017 Hypoxic Events

- In Florida, bass are physiologically stressed at DO levels below 2 mg/L, and may die *en masse* at DO levels less than 1 mg/L.
- The Kissimmee River population of largemouth bass (here split out from other species) experienced substantial setbacks in the 2017 wet season, with a severe DO crash and fish kill in June followed by another crash in September after Hurricane Irma.
- Bass (especially larger, reproductive-sized bass) are highly sensitive to low DO. Populations have been impacted for years by hypoxic events, resulting in low abundance of bass in recent years compared to data collected from a semi-restored channel in 1988 (in which ~ 40 BPUE of bass were recorded).
- Our hypothesis is that this decline is due to almost annual hypoxic or anoxic events since restoration of flow in these channels.
- Almost no bass were recorded in the 2017 summer and fall surveys, and that none were large suggests it will take years for the population to recover even to pre-2017 levels.
- In terms of biomass, sunfish populations including bass are severely depressed. This is likely due to recurring hypoxic and anoxic events.
- The District continues to work to reduce the severity and duration of Kissimmee River hypoxic events to the extent possible.



# Good Bluegill Recruitment During Post-Irma Floodplain Inundation

- An encouraging note is that numbers of small, first-year individuals of another sunfish, bluegill, were very high in the post-Irma survey, suggesting that this species, which reproduces in the summer, may have benefitted from refugia available on the floodplain during the long period of floodplain inundation



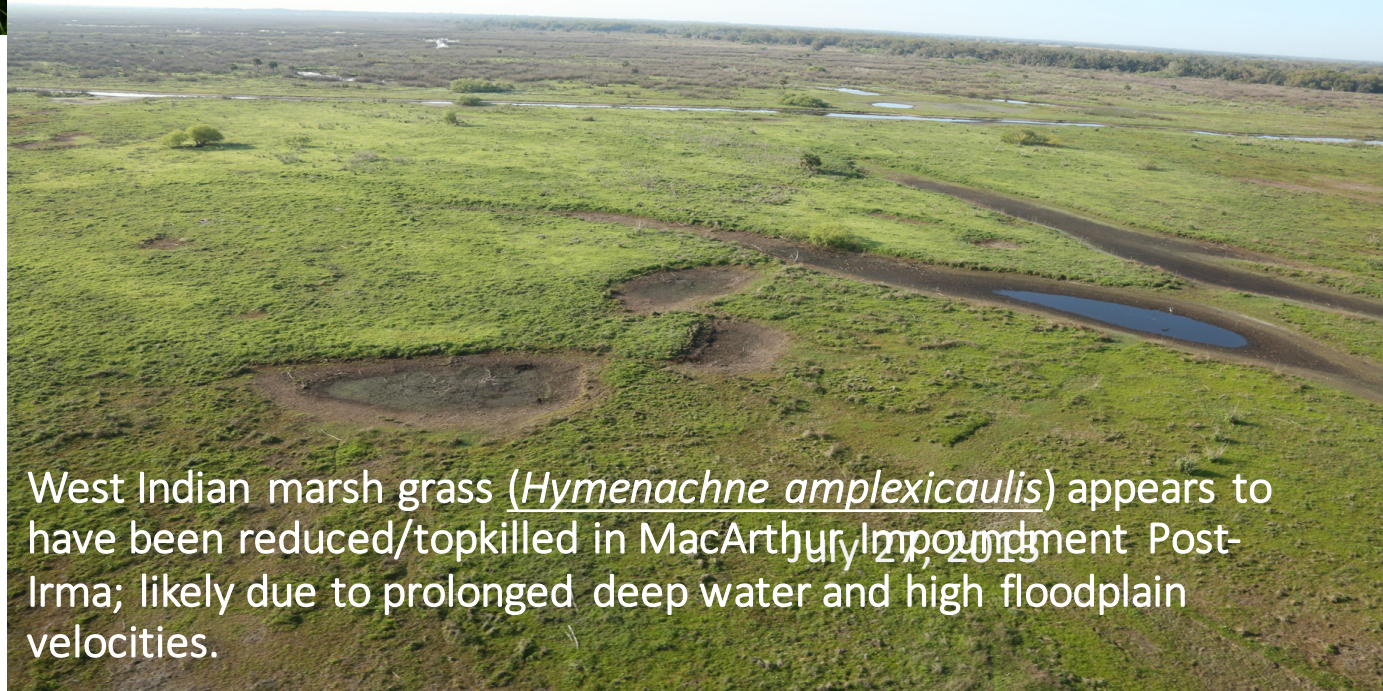




## Positive Effects on the Floodplain

- The photo to the left shows a monoculture of the invasive exotic, West Indian marsh grass, in MacArthur Impoundment in the Phase I restoration area.
- This and other invasive grasses have encroached on much of the Kissimmee River restoration area floodplain.

- Field staff report that areas formerly dominated by exotic grasses were cleared out by the prolonged deep water and high flow during Hurricane Irma (photo lower right), providing newly open substrate for native plant recruitment and wading bird foraging.



West Indian marsh grass (*Hymenachne amplexicaulis*) appears to have been reduced/topkilled in MacArthur Impoundment Post-Irma; likely due to prolonged deep water and high floodplain velocities.